Regional Operational Plan SF.1J.2016.01

Southeast Alaska Steelhead Trout Escapement Index Surveys: 2016 and 2017

by

Patrick Fowler

January 2016

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)	
centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)	
cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature	
day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry	
all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General	
Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics	
all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

REGIONAL OPERATIONAL PLAN SF.1J.2016.01

SOUTHEAST ALASKA STEELHEAD TROUT ESCAPEMENT SURVEYS: 2016 AND 2017

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Signature Page

Project Title:	Southeast Alaska Steelhead Trout Escapement Surveys: 2016 and 2017
Project leader(s):	*Patrick Fowler, Fishery Biologist III*
Division, Region and Area	Division of Sport Fish, Region I, Petersburg
Project Nomenclature:	F-10-30, F-10-31, F-10-32; Job S-1-16
Period Covered	January 2016-January 2018
Field Dates:	April 15-June 1, 2016 and 2017
Plan Type:	Category I

Approval

Title	Name	Signature	Date
Project leader	Patrick Fowler	Patrick Fowler	12-23-15
Management Coordinator	Bob Chadwick	Bob Chadwick	12-23-15
Research Coordinator	Jeff Nichols	[illegible]	12-23-15

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PURPOSE

This project is a continuation of a long-term indicator study designed to monitor steelhead escapement within select streams across Southeast Alaska. Snorkel surveys will be used to enumerate adult steelhead within 10 index streams during times of peak inriver abundance during 2016 and 2017. This information is used to evaluate annual and regional trends in escapement, provide inseason information to fisheries managers, and provide information for regulatory decisions. This operational plan details planned activities for the 2016 and 2017 seasons.

Key word: steelhead, escapement, snorkel surveys

BACKGROUND

Steelhead *Oncorhynchus mykiss* are found in coastal streams of Alaska from Dixon Entrance to the Cold Bay area on the Alaska Peninsula. Southeast Alaska has 322 watersheds known to support annual escapements of steelhead. Most populations are believed to contain 200 or fewer spawning adults while a small number of systems support returns up to 1,000 adults and the largest known producer, the Situk River, has observed adult emigration between 4,864 and 15,003 between the years 2004 to 2014(Marston 2014).

In the late 1980's and early 1990's fishery managers and anglers observed indications of declining steelhead abundance in Southeast Alaska (Johnson and Jones 1998). In response to these concerns, emergency order authority was used to restrict select steelhead fisheries between 1991 and 1993. In 1994, the Alaska Board of Fisheries (Board) adopted conservative steelhead regulations in the sport fishery by establishing a regionwide minimum size limit of 36 inches with an annual harvest limit of two. The Board also prohibited the sale of incidentally caught steelhead in commercial fisheries during this time.

In light of the declining steelhead abundance, design and implementation of a cost effective method to monitor trends in steelhead stock abundance became necessary. Prior to 1994, opportunistic steelhead foot surveys were conducted on a small number of streams. These limited surveys provided little utility in identifying regional trends. Consistent foot surveys to monitor peak steelhead abundance were initiated in 1994 (Johnson and Jones 1998). Substantial positive changes in survey methods were instituted in 1997 by establishing index streams dispersed across Southeast Alaska, increasing the proportion of steelhead observed in index streams, and increasing survey frequency to better identify peak timing of instream abundance. Notably, snorkeling was adopted as the standard method for conducting steelhead index surveys in alignment with the findings of Shardlow et al. (1987) that experienced snorkel surveyors generally observe the highest proportion of inriver steelhead among all common survey methods. Snorkel surveys have continued to be conducted on index streams each year since 1997. Survey methodology has largely remained stable although some index streams have changed and individual areas selected for surveys have been modified (Johnson and Jones 1998-2001; 2003; Harding 2005; Harding and Love 2008; Harding 2009; Harding 2012; Coyle 2012; Coyle 2013). Results from prior years of this project are published within the Alaska Department of Fish and Game, Fisheries Data Series; most recently in Coyle (2012).

OBJECTIVES

The objectives of this project in 2016 and 2017 will be to:

1. Conduct snorkel surveys to enumerate adult steelhead during times of peak abundance within established areas of 10 previously selected index streams within Southeast Alaska.

Secondary Objectives

In addition this project will:

1. Monitor water temperature in each of the index streams in a manner useful for long term analysis.

METHODS

Study Design

Snorkel surveys will be conducted within selected reaches of the 10 established index streams distributed across Southeast Alaska (Table 1; Figure 1). Within each index stream defined reaches have been established in which snorkel surveys are conducted (Appendix A). In order to preserve the continuity of this long-term dataset, survey methods and the areas surveyed are intended to remain stable across seasons and years. No changes to the areas surveyed or survey methodology is expected to take place in the 2016 and 2017 seasons.

Surveys are conducted annually, each spring between mid-April and the beginning of June. Weir data from across the region and historic steelhead survey information have collectively been used to anticipate periods of peak abundance for each index stream (Table 2; Figure 2). Index streams have been classified based on arrival timing into “early” and “late” categories. Early system surveys begin in mid-April, while late system surveys begin in late April or early May (Table 1). Interannual variation in run timing can occur necessitating an earlier or later start in order to efficiently capture a peak survey count. The area management biologist supervising surveys in the area may contact the project manager and seek approval to modify the timing of surveys according to inseason environmental conditions and steelhead observations.

Surveys are conducted approximately on a seven day interval beginning the week before the expected peak abundance and concluding the week after peak abundance. Tagging studies at weirs (Hoffman et al. 1990; Love and Harding 2008) and information on instream abundance over time (Table 2) suggest residence time for individuals and instream abundance peaks usually last a week or more. Three surveys are planned for each index system with the intent to bracket the peak survey count between lower counts, suggesting that a survey was conducted during the period of peak abundance. Additional surveys should be conducted if the highest count is observed on the third survey and surveys should continue until a lower count is observed. Surveys successfully achieving a bracketed peak count are noted as “peak counts” and are used in regional trend analysis. Occasionally a bracketed peak count is unable to be achieved due to conditions such as an earlier than anticipated run timing or poor weather conditions. If a bracketed peak count is not achieved, the highest count conducted will be noted as the “high count” but will be precluded from select data analysis. If a scheduled survey is missed, the survey will be performed as soon as conditions permit. In addition to the identified index streams, other streams may be surveyed as time, funding, and management priorities dictate. Surveys conducted on non-index streams will be recorded and archived in the same manner as index streams but will not be included in regional trend analysis.

There are several underlying assumptions when using snorkel counts as an index of population abundance. It is assumed that there is no interannual variation in observer efficiency, coverage of arrival timing, or duration of the peak time that spawners spend in the system (Korman et al. 2002). It is also assumed that there is no change in detection probabilities as changes in absolute abundance occur.

While snorkel surveys do not enumerate the entire spawning population of an index stream the standardized methodology across years offer the opportunity to monitor trends across time. In addition to identifying trends in abundance, snorkel surveys provide fisheries managers with inseason knowledge of surveyed streams which can be used to take management actions needed to protect the sustainability of a specific steelhead population or the Southeast Alaska steelhead stock. Stock status information from this project is routinely provided to the Alaska Board of Fisheries and as background information for regulatory proposals.

SAMPLING METHODS

Surveys are conducted by a team of at least two surveyors equipped with dry suits, masks and snorkels. One of these surveyors is designated the lead who will always be an experienced observer. A third team member who transports gear and provides bear protection is often used on Ford Arm creek, Stikoh creek, Peterson creek and Pleasant Bay creek. Surveys are conducted by starting at the upper end of a survey area (Appendix A) and snorkeling downstream while counting all steelhead observed within each area. *O. mykiss* approximately 22 inches or greater in total length are counted as adult steelhead for the purpose of these surveys. Length data collected at various weirs in Southeast Alaska indicate that steelhead smaller than 22 inches are rare but have been observed (Love et al. 2012b and 2013; Jones 1972, 1973, 1974 and 1975; Piazza 2009a and 2009b; B. Marston, Sport Fish Biologist, ADFG, Yakutat, personal communication). At river sections when water conditions are not conducive to snorkeling (i.e. shallow riffles, log jams, high energy sections….) the survey crew will continue counting steelhead through a visual count by foot using polarized glasses. The surveyors should attempt to stay abreast of each other in the stream and coordinate their observations to obtain maximum coverage. The number of steelhead observed will be temporarily recorded on either hand counters (tallywackers), waterproof notebooks, or on a small diver's slate and tallied at the end of each area. When passing through high concentrations of steelhead, both observers will count the number of steelhead in their area of responsibility and then consult with each other on their counts. If any member of the survey crew feels that a questionable count was made in a particular section of stream, that section will be recounted until agreement is met. Particular attention should be given to observing steelhead along wide, brushy-edged cut bank habitats, and deep pools or the thalweg adjacent to areas of spawning. When approached by a snorkeling observer, steelhead tend to school against the downstream edge of the habitat where encountered before passing to the upstream side of the snorkeling observer. In addition to recording the number of observed steelhead, surveyors may record other information such as the number of steelhead redds or counts of other species. This information will be recoded on survey forms and archived in spreadsheets along with the steelhead-specific survey data.

Aquatic and environmental variables will be recorded at the beginning of each survey. Variables include surface water temperature in degrees Celsius, weather conditions, water level and the quality of subsurface visibility. Subsurface visibility will be measured using a Secchi disk at a consistent location within each system. The Secchi disk will be held underwater by one observer approximately 8 inches below the surface. The second snorkel observer will then back away underwater keeping visual contact with the disk and feeding out the line while continuing backwards. The point at which the Secchi disk disappears and then reappears is the distance that should be recorded on data form. In some conditions the aspect of the sun highlights particulate in the water column which may obscure visibility in one direction while enhancing visibility in the other direction. Under these conditions the survey crew should take two Secchi disk measurements, one looking towards each streambank. Water levels will be measured at permanently established benchmarks on each index system in order to compare water levels between surveys (locations described in Appendix A). For each survey conducted, a survey form (Figure 2) will be completed and submitted to the project leader as soon as the survey team returns to the office.

Safety is a primary consideration and observers should train with experienced personnel before conducting surveys. If any member of the snorkel team considers conditions unsafe, the survey will be postponed until conditions are more favorable. If rain, wind, or turbidity obscure subsurface visibility, the survey will be halted temporarily or postponed until conditions improve.

An automatic water temperature recording device (Hobo™[1] Water Temp Pro V2) has been installed in each index stream and has been programed to record the water temperature on an hourly basis for the entire year. During the survey season each device will either be downloaded on site by the survey crew or removed and replaced with a new temperature logger. Water temperature data or the loggers themselves will be delivered to the project leader for download and analysis. Water temperature monitoring sites have been selected for representative thermal mixing and long term stability. Every attempt should be made to maintain the logger at the same location to enable multi-year comparisons of water temperature data. In an effort to ensure a water temperature dataset that is useful for long term and regional analysis, the best practices described by Mauger et al. (2014) have been adopted beginning with the 2016 season.

DATA ANALYSIS

Survey counts and environmental data recorded on survey forms will be entered into Microsoft Excel™ spreadsheets. Environmental data will be used to interpret the relative quality and accuracy of each survey. Survey counts will be compared to historic surveys from prior years of this project to examine trends in abundance across years. Observed run timing in the 2016 and 2017 seasons will be used for planning and scheduling of future steelhead snorkel surveys.

Water temperature data collected from automatic water temperature recording devices will be downloaded, examined for erroneous data, compared to timing of snorkel surveys, and archived.

SCHEDULE AND DELIVERABLES

Schedule of activities for the 2016-2017 seasons.

[1] Product names are included for completeness and do not constitute product endorsement.

Date	Activity
Week of April 16–23, 2016 and 2017	Begin surveys on early systems (Table 1)
Week of April 30	Begin surveys on late systems (Table 1)
Late May to early–June	Complete all snorkel surveys
Weekly while surveys are being conducted	Data is reported to project leader where it is organized into a weekly report and delivered to fisheries managers.
September, 2018	Draft summary report covering 2016 and 2017

This project will produce a draft Fishery Data Series report with counts for each of the survey reaches summarized for the 2-year reporting period (2016 and 2017) by September 2018.

RESPONSIBILITIES

Patrick Fowler, Fishery Biologist III, Petersburg/Wrangell Area Management Biologist

> Duties: Prepare operational plan, enter survey results into the steelhead snorkel survey spreadsheets, write FDS report, and conduct and/or supervise staff who conduct snorkel surveys in the Petersburg/Wrangell Management Area.

Jeff Nichols, Fishery Biologist IV, Regional Research Coordinator.

> Duties: Research oversight, assist with plan preparation and snorkel surveys; review operational plan, FDS report, and data analysis.

Bob Chadwick, Fishery Biologist IV, Regional Management Coordinator.

> Duties: Management oversight, operational planning, and coordinate index surveys in all management areas, assist with snorkel surveys.

Kelly Piazza, Fishery Biologist III, Ketchikan Area Management Biologist.

> Duties: Conduct and/or supervise staff who conduct snorkel surveys in the Ketchikan Management Area.

Mike Wood, Fish and Game Technician IV

> Duties: Assist with snorkel surveys.

Todd Johnson, Fishery Biologist II

> Duties: Assist with snorkel surveys.

Craig Schwanke, Fishery Biologist III, Prince of Wales Area Management Biologist

Duties: Conduct and/or supervise staff who conduct snorkel surveys in the Prince of Wales Management Area.

Vera Goudima, Fish and Game Technician III

Duties: Assist with snorkel surveys.

Troy Tydingco, Fishery Biologist III, Sitka Area Management Biologist

Duties: Conduct and/or supervise staff who conduct snorkel surveys in the Sitka Management Area.

Matt Catterson, Fishery Biologist I, Assistant Sitka Area Management Biologist

Duties: Assist with snorkel surveys.

Monica Matz, Program Technician

Duties: Assist with snorkel surveys.

Dan Teske, Fishery Biologist III, Juneau Area Management Biologist.

Duties: Conduct and/or supervise staff who conduct snorkel surveys in the Juneau Management Area.

Judy Lum, Fishery Biologist IV, Regional Enhancement Biologist

Duties: Assist with snorkel surveys.

Dave Love, Fishery Biologist II, Assistant Juneau Area Management Biologist.

Duties: Assist with snorkel surveys.

REFERENCES CITED

Bain, C., S. T. Elliott, R. E. Johnson, and G. Woods. 2003. Situk River steelhead: a review of historical data through 1996. Alaska Department of Fish and Game, Fisheries Manuscript No. 03-01, Anchorage.

Coyle, C.L. 2012. Southeast Alaska steelhead snorkel surveys of regional index streams, 2010 and 2011. Alaska Department of Fish and Game, Fishery Data Series No. 12-79, Anchorage.

Coyle, C.L. 2013. Southeast Alaska steelhead trout escapement surveys: 2013. Alaska Department of Fish and Game, Division of Sport Fish, Regional Operational Plan No. SF.1J.2013.03, Anchorage.

Freeman G.M. 1995. An evaluation of steelhead enhancement in the Ward Creek Drainage, Ketchikan Alaska, 1991-1994. Alaska Department of Fish and Game, Fisheries Data Series No. 95-2, Anchorage

Harding, R.D. 2005. Southeast Alaska steelhead snorkel surveys of regional index streams, 2002 and 2003. Alaska Department of Fish and Game Fishery Data Series No. 05-74, Anchorage.

Harding, R.D. 2009. Southeast Alaska steelhead snorkel surveys of regional index streams, 2006 and 2007. Alaska Department of Fish and Game Fishery Data Series No. 09-74, Anchorage.

Harding, R.D. 2012. Southeast Alaska steelhead snorkel surveys of regional index streams, 2008 and 2009. Alaska Department of Fish and Game Fishery Data Series No. 12-08, Anchorage.

Harding, R.D., and C.L. Coyle. 2011. Southeast Alaska steelhead, trout, and Dolly Varden management. Alaska Department of Fish and Game, Special Publication No. 11-17, Anchorage.

REFERENCES CITED (CONTINUED)

Harding, R.D., and D.C. Love. 2008. Southeast Alaska steelhead snorkel surveys of regional index streams, 2004 and 2005. Alaska Department of Fish and Game Fishery Data Series No. 08-74, Anchorage.

Harding, R., and D. Jones. 1990. Peterson Creek and lake system steelhead evaluation. 1989. Alaska Department of Fish and Game, Fisheries Data Series No. 90-37, Anchorage

Harding, R., and D. Jones. 1991. Peterson Creek and lake system steelhead evaluation.1990. Alaska Department of Fish and Game, Fisheries Data Series No. 91-31, Anchorage.

Harding, R., and D. Jones. 1992. Peterson Creek and lake system steelhead evaluation.1991. Alaska Department of Fish and Game, Fisheries Data Series No. 92-46, Anchorage.

Harding, R., and D. Jones. 1994. Sitkoh Creek steelhead: 1993 escapement and harvest. Alaska Department of Fish and Game, Fishery Data Series No. 94-36, Anchorage.

Hoffman, S. H. 2007. Weir enumeration and assessment of mark-recapture estimates for steelhead abundance in Twelve Mile Creek, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-34, Anchorage.

Hoffman, S. H. 2008. Steelhead abundance and composition in the Karta River, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 08-13, Anchorage.

Hoffman, S.H., Koerner, J. and Magnus, D. 1990. Steelhead habitat preference, creel census, and recreation survey on the Karta River, Southeast, Alaska, 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-45, Anchorage.

Jones, Darwin E. 1972. A study of steelhead-cutthroat trout in Alaska. Alaska Dept. of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1971-1972. Project F-9-4. 13(G-II-I). pp. 91-108.

Jones, Darwin E. 1973. Steelhead and sea-run cutthroat trout life history in southeast Alaska. Alaska Dept. of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1972-1973. Project AFS-42. 14(AFS-42-1). pp. 1-18.

Jones, Darwin E. 1974. Life history of steelhead trout in southeast Alaska. Alaska Dept. of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1973-1974. Project AFS-42. 15(AFS-42-2). pp. 1-14.

Jones, Darwin E. 1975. Life history of steelhead trout. Alaska Dept. of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1974-1975. Project AFS-42. 16(AFS-42-3-A). pp. 1-22.

Jones, Darwin E. 1976. Life history of steelhead trout. Alaska Dept. of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1975-1976. Project AFS-42. 17(AFS-42-4-A). pp. 1-27.

Jones, J. D., R. Harding, and A. Schmidt. 1991. Sitkoh Creek steelhead study, 1990. Alaska Department of Fish and Game, Fisheries Data Series No. 91-32, Anchorage

Johnson, R. E., and Jones, J. Douglas. 1998. Southeast Alaska steelhead studies, 1997: Situk River weir and surveys of index streams. Alaska Department of Fish and Game, Fishery Data Series No. 98-45, Anchorage.

Johnson, R. E., and Jones, J. Douglas. 1999. Southeast Alaska steelhead studies, 1998: Situk River weir and surveys of regional index streams. Alaska Department of Fish and Game, Fishery Data Series No. 99-33, Anchorage.

Johnson, R. E., and Jones, J. Douglas. 2000. Southeast Alaska steelhead studies, 1999: Situk River weir and surveys of regional index streams. Alaska Department of Fish and Game, Fishery Data Series No. 00-22, Anchorage.

Johnson, R. E., and Jones, J. Douglas. 2001. Southeast Alaska steelhead studies, 2000: Situk River weir and surveys of regional index streams. Alaska Department of Fish and Game, Fishery Data Series No. 01-20, Anchorage.

Johnson, R. E., and Jones, J. Douglas. 2003. Southeast Alaska steelhead studies, 2001: Situk River weir and surveys of regional index streams. Alaska Department of Fish and Game, Fishery Data Series No. 03-18, Anchorage.

Korman, J., R.N.M. Ahrens, P.S. Higgins, and C.J. Wlaters. 2002. Effects of observer efficiency, arrival timing, and survey life on estimates of escapements for steelhead trout (Oncorhynchus mykiss) derived from repeat mark-recapture experiments. Can. J. Fish. Aquat. Sci. 59:1116-1131.

REFERENCES CITED (CONTINUED)

Love, D. C., and R. D. Harding. 2008. Steelhead trout production studies at Sitkoh Creek, Alaska, 2003 and 2004. . Alaska Department of Fish and Game, Fisheries Data Series No. 08-44, Anchorage.

Love, D. C., and R. D. Harding. 2009. Steelhead trout production studies at Sitkoh Creek, Alaska, 2005 and 2006. . Alaska Department of Fish and Game, Fisheries Data Series No. 09-68, Anchorage.

Love, D.C., C.L. Coyle and R.D. Harding. 2012 a. Steelhead trout studies at Sitkoh Creek, Alaska, 2007 and 2008. Alaska Department of Fish and Game, Fishery Data Series No. 12-60, Anchorage.

Love, D. C., D.J. Reed and R. D. Harding. 2012 b. Steelhead trout production studies at Sitkoh Creek, Alaska, 2003-2009, and 2009 final report. Alaska Department of Fish and Game Fishery Data Series No. 12-82, Anchorage

Love, D.C., R.D. Harding, and D.J. Reed. 2013. Steelhead Trout Production Studies at Big Ratz Creek, Alaska, 2010-2011. Alaska Department of Fish and Game, Fishery Data Series No. 13-02, Anchorage.

Marston, Brian H. 2014. Situk River steelhead stock assessment, 2014–2015. Alaska Department of Fish and Game, Regional Operational Plan No. SF.1J.2014.09, Anchorage.

Mauger, S., R. Shaftel, E.J. Trammel, M. Geist, and D. Bogan. 2014. Stream temperature data collection standards and protocols for Alaska: minimum standards to generate data useful for regional-scale analyses. Cook Inletkeeper, Homer, AK and Alaska Natural Heritage Program, UAA, Anchorage, AK. 51 pp.

Piazza, K. S. 2009a. Assessment of adult steelhead populations on Prince of Wales Island Alaska: Big Ratz Creek and Nazuhini Creek, 2007 and 2005–2007 final report. Alaska Department of Fish and Game, Fishery Data Series No. 09-56, Anchorage.

Piazza, K. S. 2009b. Assessment of Adult Steelhead Populations on Prince of Wales Island, Alaska: Eagle Creek and Cable Creek, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-14, Anchorage.

Piazza, K. S., G. K. Chen, and R. Mullen. 2008. Assessment of adult steelhead populations on Prince of Wales Island, Alaska: Harris River and Big Ratz Creek, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 08-46, Anchorage.

Shardlow, T., R. Hilborn, and D. Lightly. 1987. Components analysis of instream escapement methods for Pacific salmon (Oncorhynchus spp.). Can. J. Fish. Aquat. Sci., Vol. 44, 1031–1037.

Yanusz, Richard. 1997. Sea-run cutthroat trout, sea-run Dolly Varden, and steelhead population status at Sitkoh Creek, Southeast Alaska, during 1996. Fishery Data Series No. 97-23, Anchorage.

Yanusz, R. J. 1998. Sockeye salmon escapement to Windfall Lake during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-32, Anchorage.

TABLES AND FIGURES

Figure 1.–Location of the ten index streams in Southeast Alaska and the Situk River near Yakutat.

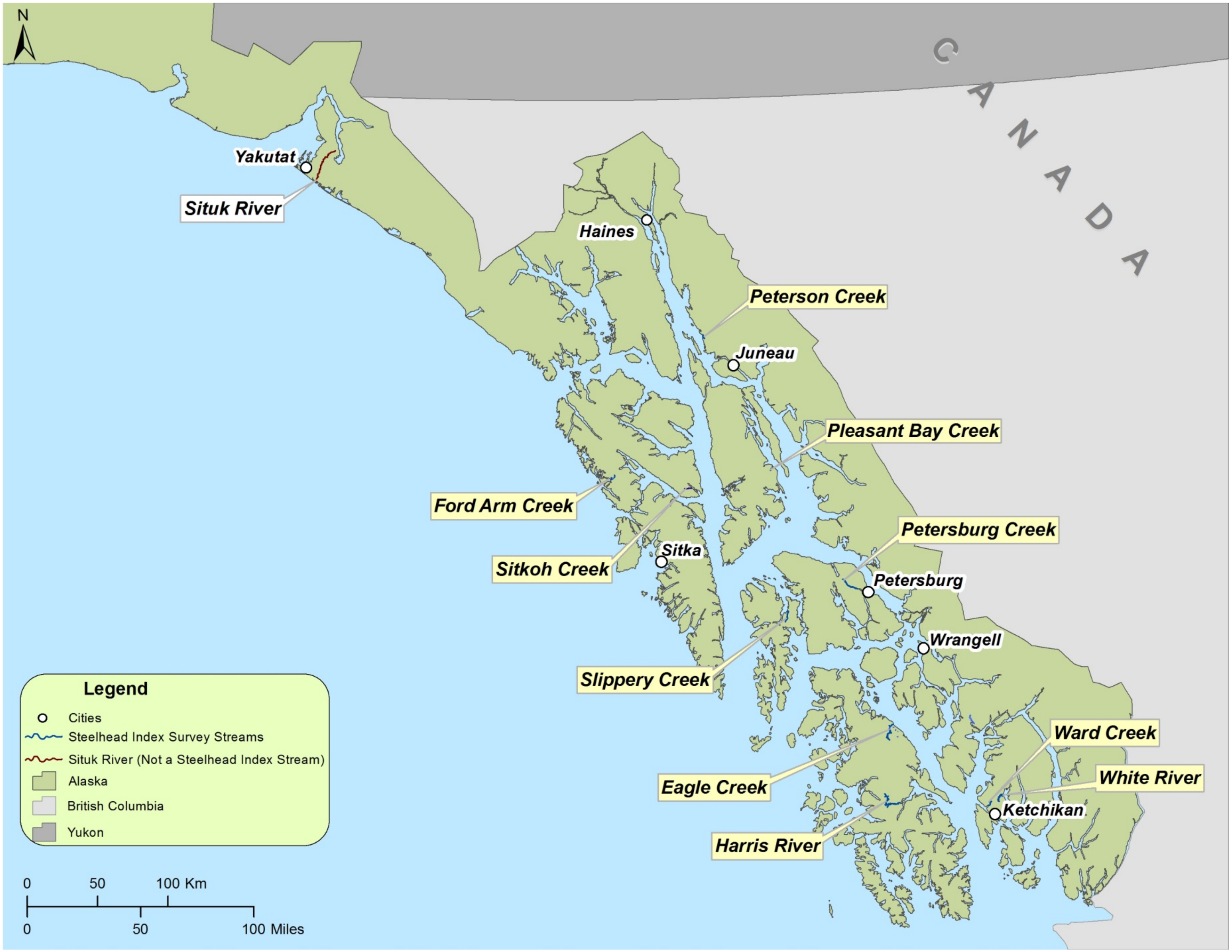


Table 1.–Index streams grouped by survey start times.

	Index stream name	Anadromous stream number	Management area	Target survey start date
Early systems				
	White River	101-45-10240	Ketchikan	16-23 April
	Ward Creek	101-47-10150	Ketchikan	16-23 April
	Harris River	102-60-10820	POW	16-23 April
	Eagle Creek	106-10-10300	POW	16-23 April
Late systems				
	Petersburg Creek	106-44-10600	Petersburg	30 April
	Slippery Creek	109-43-10030	Petersburg	30 April
	Ford Arm Creek	113-73-10030	Sitka	30 April
	Sitkoh Creek	113-59-10040	Sitka	30 April
	Peterson Creek	111-50-10100	Juneau	30 April
	Pleasant Bay Creek	111-12-10050	Juneau	30 April

Table 2.–Steelhead run timing at weirs in Southeast Alaska including dates when 75% and 90% of the upstream immigrations were complete and, where available, the estimated peak of inriver abundance (immigration counts minus emigration counts).

Stream	Year	Immigration 75%	Immigration 90%	Peak of inriver abundance
Karta River	1989[a]	30–Apr	11–May	16–May
	1992[b]	1–May	9–May	2–May
	2005[c]	30–Apr	15–May	5–May
Ward Creek	1993[d]	10–May	15–May	17–May
	1994	8–May	20–May	21–May
Sitkoh Creek	1936[e]	19–May	23–May	ND
	1937[e]	23–May	28–May	ND
	1982[f]	17–May	22–May	ND
	1990[g]	11–May	17–May	15–May
	1993[h]	11–May	18–May	19–May
	1996[i]	15–May	24–May	19–May
	2003[j]	7–May	18–May	11–May
	2004[j]	9–May	16-May	13–May
	2005[k]	8–May	17–May	9–May
	2006[k]	21–May	26–May	26–May
	2007[l]	24–May	31–May	20–May
	2008[l]	22–May	28–May	23–May
	2009[m]	14–May	27–May	27–May
Peterson Creek	1989[n]	16–May	25–May	21–May
	1990[o]	20–May	26–May	24–May
	1991[p]	16–May	20–May	22–May
	2010 [cc]	6–May	11–May	12–May
	2011 [cc]	20–May	30–May	20–May
Petersburg Creek	1973[q]	ND	ND	25–May
	1974[r]	18–May	24–May	25–May
	1975[s]	21–May	28–May	29–May
Ratz Creek	2010 [bb]	7–May	19–May	9–May
	2011[bb]	13–May	23–May	14–May
Situk River	1994[t]	ND	ND	21–May
	1996[u]	ND	ND	18–May
	1997[v]	ND	ND	5–May
Windfall Creek	1997[w]	8–May	12–May	24–May
12 Mile Creek	2004[x]	18–Apr	26–April	ND
Natzuhini Creek	2007 [y]	11–May	20–May	ND
Cable Creek	2006 [z]	1–May	8–May	ND
Eagle/Luck Creek	2006 [z]	12–May	19–May	ND
Harris River	2005 [aa]	27–Apr	12–May	ND

[a] Hoffman et al. (1990)
[b] Harding and Jones (1993)
[c] Hoffman (2008)
[d] Freeman (1995)
[e] Reported in 5-day intervals (Chipperfield, W.A. *Unpublished*. Report on Dolly Varden trout research Sitkoh Bay stream. U.S.Forest Service, Juneau, AK)
[f] Jones (1983)
[g] Jones et. al. (1991)
[h] Harding and Jones (1994)
[i] Yanusz (1997)
[j] Love and Harding (2008)
[k] Love and Harding (2009)
[l] Love et al. (2012a)
[m] Love et al. (2012b)
[n] Harding and Jones (1990)
[o] Harding and Jones (1991)
[p] Harding and Jones (1992)
[q] Petersburg Creek, Jones (1972–1974)
[r] Jones (1975)
[s] Jones (1976)
[t] Johnson (1996)
[u] Bain et al (2003)
[v] Johnson and Jones (1998)
[w] Yanusz (1998)
[x] Hoffman (2007)
[y] Piazza (2009a)
[z] Piazza (2009b)
[aa] Piazza et al. (2008)
[bb] Love et al. (2013) and David Love, ADF&G fisheries biologist, Douglas, Alaska, personal communication
[cc] Coyle (2012)

Figure 2.-Timing of historic bracketed peak surveys on index streams by year.

Index Stream	April 17 – 23	April 24 – 30	May 1 – 7	May 8 – 14	May 15 – 21	May 22 – 28	May 29 – June 4	June 5 – 11
White River	2013	2010	1998, 2000, 2001, 2003, 2008	2002, 2007, 2011	2006, 2009	–[a]	–[a]	–[a]
Ward Creek	–[a]	–[a]	2014	2005, 2015	2004	–[a]	–[a]	–[a]
Harris River	2013	1999, 2009, 2015	1998, 2000, 2004, 2005, 2007, 2010, 2012, 2014	2006	–[a]	–[a]	–[a]	–[a]
Eagle Creek	–[a]	–[a]	1998, 2000, 2010, 2013, 2014, 2015	2002	–[a]	2009, 2012	–[a]	–[a]
Petersburg Creek	–[a]	–[a]	1998, 2003, 2005, 2006, 2014	1999, 2004, 2007, 2008, 2009, 2010, 2011, 2013	–[a]	2012	–[a]	–[a]
Slippery Creek	–[a]	2004	2008, 2010	2009, 2012	2011	2007	–[a]	–[a]
Ford Arm Creek	–[a]	–[a]	2005	2004, 2006, 2011, 2012, 2015	2003, 2010, 2013, 2014	2000	2007, 2008, 2009	–[a]
Sitkoh Creek	–[a]	2003	2011, 2014	2004, 2005, 2015	2006, 2012	2009, 2013	–[a]	2008
Pleasant Bay Creek	–[a]	–[a]	1998, 2000, 2003, 2004, 2010	2009, 2015	2002, 2008, 2011, 2012	2007	–[a]	–[a]
Peterson Creek	–[a]	–[a]	2005	2003, 2010	2001, 2002, 2006, 2007, 2009, 2012	1997, 2008, 2011, 2013	–[a]	–[a]

[a] No bracketed peak survey count was obtained.

Figure 3.- Steelhead snorkel survey data form.

Steelhead Snorkel Survey

Stream Name: Survey Date: _____/_____/16

Survey Area Number	Initials - Primary Observer	Survey Area Name or Description	Survey Type Code	Distance Surveyed (miles)	Tide Code	Visibility Code	Water Level Code	Weather Code	Staff Gauge Level/Depth (cm)	Secchi Disk (meters)	Water Surface Temp. (°C)	**Steelhead live**	**Steelhead dead**	# Redds	Rainbow	Dolly Varden	Cutthroat	Coho	Comments

Total steelhead: ________

Additional comments:

Survey Type Code	Tide Codes	Visibility Codes	Water Level Codes	Weather Codes
F = Foot	41 = High	21 = Exceller	31 = High	C = Clear
S = Snorkel	42 = Low	22 = Normal	32 = Norma	O = Overcast
B = Boat	43 = Interm	23 = Poor	33 = Low	R = Raining
				W = Wind on Water surface

Observer Names: ____

APPENDIX A:

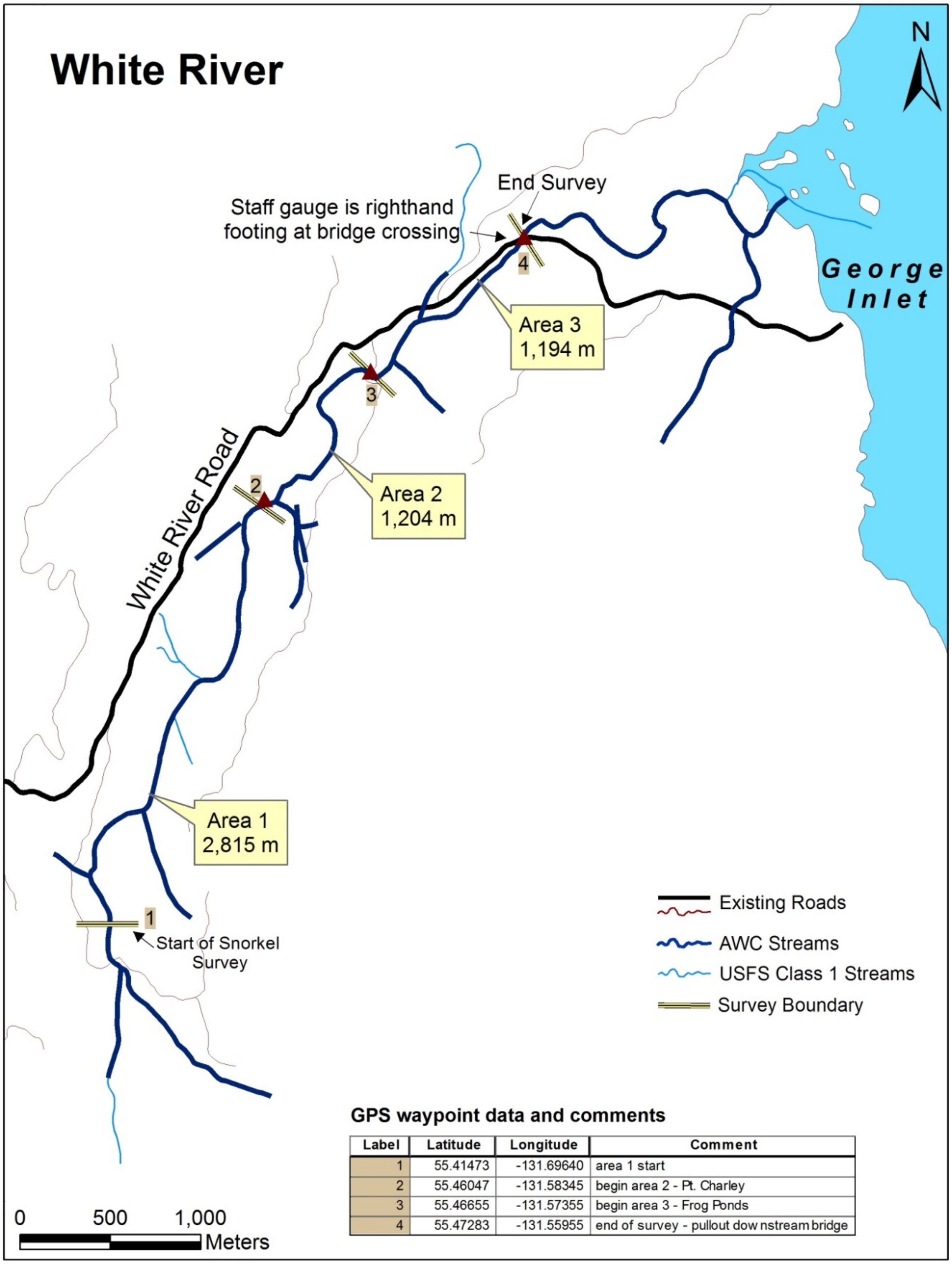
SITE SPECIFIC INFORMATION AND STREAM MAPS

Appendix A1.–Site specific information for steelhead index systems,

Management area: Stream name (Streams in **Bold** are annual index streams)	**Description of index area and directions for access**
Ketchikan: **White River**	Obtain key from Cape Fox Corporation to access locked gate. Drive out Ward Lake Road to the locked gate accessing Cape Fox property. Area 1 starts in upper reach of creek at merger of three forks and continues downstream to second large logjam going downstream. The top of this area is reached by traveling down the first right hand spur road down into this drainage. Area 2 runs from the log jam downstream to the removed logging bridge. Area 3 runs from pulled bridge downstream to ¼ mile below lower bridge crossing of White River. Survey is facilitated by leaving second vehicle at lower bridge crossing of White River. The water level is measured from the lower bridge located in Area 3.
Ketchikan: **Ward Creek**	Drive to Grassy Point parking area to drop off a second vehicle and proceed to Connell Lake Dam parking area. Walk down the footpath to the base of the dam and start survey. Area 1 begins at the base of the dam and continues to the top of the gorge located downstream from Last Chance Campground. Pull out there and walk the Ward Creek trail approximately 0.4 miles until you see large waterfall. Return to the creek at the corner pond located at the bottom of the gorge and resume survey. Area 2 starts here and continues to the hole just above the old swinging bridge. Near the end of area 2, you will reach a large Y in the creek, proceed downstream along river-left until till the two channels come together. Walk the other stream channel upstream to the falls and survey downstream. Area 3 starts at the old swinging bridge hole and continues to Ward Lake.
POW: **Harris River**	Using two vehicles drive to the Rec Bridge and park one vehicle. Drive the second vehicle to Hydaburg Bridge where survey crew #1 hikes two pools upstream or approximately 300 yards to begin survey of reach 5. Reach 5 continues downstream to the Hydaburg Bridge. Area 4 starts at the bridge and continues for approximately 1.5 hours to the reach break for Area 4/3 where a small unnamed creek enters. Area 3 continues to the Blown Out Bridge where survey crew #1 exits the stream and walks to vehicle parked nearby. After dropping off survey crew #1 at the Hydaburg Bridge, survey crew #2 drives to the Blown Out Bridge, parks vehicle and begins survey of Area 2. Area 2 continues downstream to the Rec Bridge. Area 1 is a short reach from the Rec Bridge continuing a few hundred yards downstream. Hike back to vehicle parked at the Rec Bridge and drive to Blown Out Bridge to meet survey crew #1. Survey crews consist of 2 people for each crew for a total of 4 crew members to complete the Harris River survey as it is very long.
POW: **Eagle Creek**	Drive to upper Luck Creek to bridge on road 30334 and survey downstream to Luck Lake. Area 1 begins at the road bridge and continues to the base of the second large falls. Area 2 begins at the base of second large falls to Luck Lake. Drive around Luck Lake, stage vehicle or have driver drop off surveyors at the Luck Lake Campground and walk the beach to the outlet of Luck Lake. Area 3 begins at the outlet and continues downstream to the top of the canyon. Hike out along fisherman's trail back to vehicle. *Note:* Area 4 which began at the end of area 3 and continued to saltwater was dropped in 2014 due to safety concerns.

Management area: **Stream name**	**Description of index area and directions for access**
Petersburg: **Petersburg Creek**	Jet skiff upstream at high tide to Hammer Slough (the upper extent of tide water), adjacent to two cabins the day prior to the survey. Leave the jet skiff overnight and return to town via a second jet skiff. Fly to the lake the next day. Reach 1 begins approximately 0.5 mi below the lake outlet at the confluence with a tributary stream entering from river-right, and ends at the confluence with Shakey Frank's Creek, 2.7 miles downstream. Within this reach, a 0.6 mi portion is not surveyed for safety reasons, and bypassed using the foot trail. Reach 2 extends 1.4 mile to the large stable logjam blocking upstream boat traffic. Reach 3 extends 1.8 mi downstream ending at Hammer Slough, where three cabins are located. A benchmark includes a metal spike driven into a vertical bedrock wall on river-left, 100 meters upstream from the survey's end. When survey is completed, Jet boat back to town. Total surveyed distance is 5.3 miles.
Petersburg: **Slippery Creek**	Fly-in from Petersburg via floatplane to the outlet creek at Slippery Lake on Kuiu Island. Survey area 1 downstream .5 mile to the smolt trap site. Survey area 2 (1.5 miles) from the smolt trap to the fish pass (note any upstream fish passage problems). Record depth at the staff gauge located on the fishpass bulkhead. Hike one mile to beach for saltwater floatplane pick up in Port Camden.
Sitka: **Sitkoh Creek**	Survey area starts at the lake outlet and extends to tidewater. The survey area boundary between 1 and 2 is the logjam just above the canyon where the trail adjacent to the stream bypasses about ½ mile of high gradient water. Area 2 extends between the area where the trail again meets the stream and where a tributary enters from river left. Area 3 continues from the end of area 2 downstream to saltwater. A staff gauge installed near the outlet of the lake is used for water depth measurement.
Sitka: **Ford Arm Creek**	Survey area starts at the lake outlet and extends to tidewater. The boundary between the two stream reaches is the tributary that enters on river right about halfway through the survey. The permanent benchmark is a rock located on river right just below weir site at the outlet of the lake.
Juneau: **Pleasant Bay Creek**	Charter in to the lake and hike downstream through muskeg meadows on the right side of the stream facing downstream. Survey starts at the barrier falls and continues downstream to the break between Area 2 and Area 3 (approximately 3,000 ft above tidewater). The permanent benchmark is on the large bedrock outcropping on the right side of the stream going downstream between area 1 and area 2.
Juneau: **Peterson Creek**	Peterson Creek is located at 25 mile on Glacier Highway. Park at the main highway bridge and hike upstream to the barrier falls. Survey area goes from the falls downstream to the highway bridge. The permanent benchmark is on the steel piling under the main highway bridge.

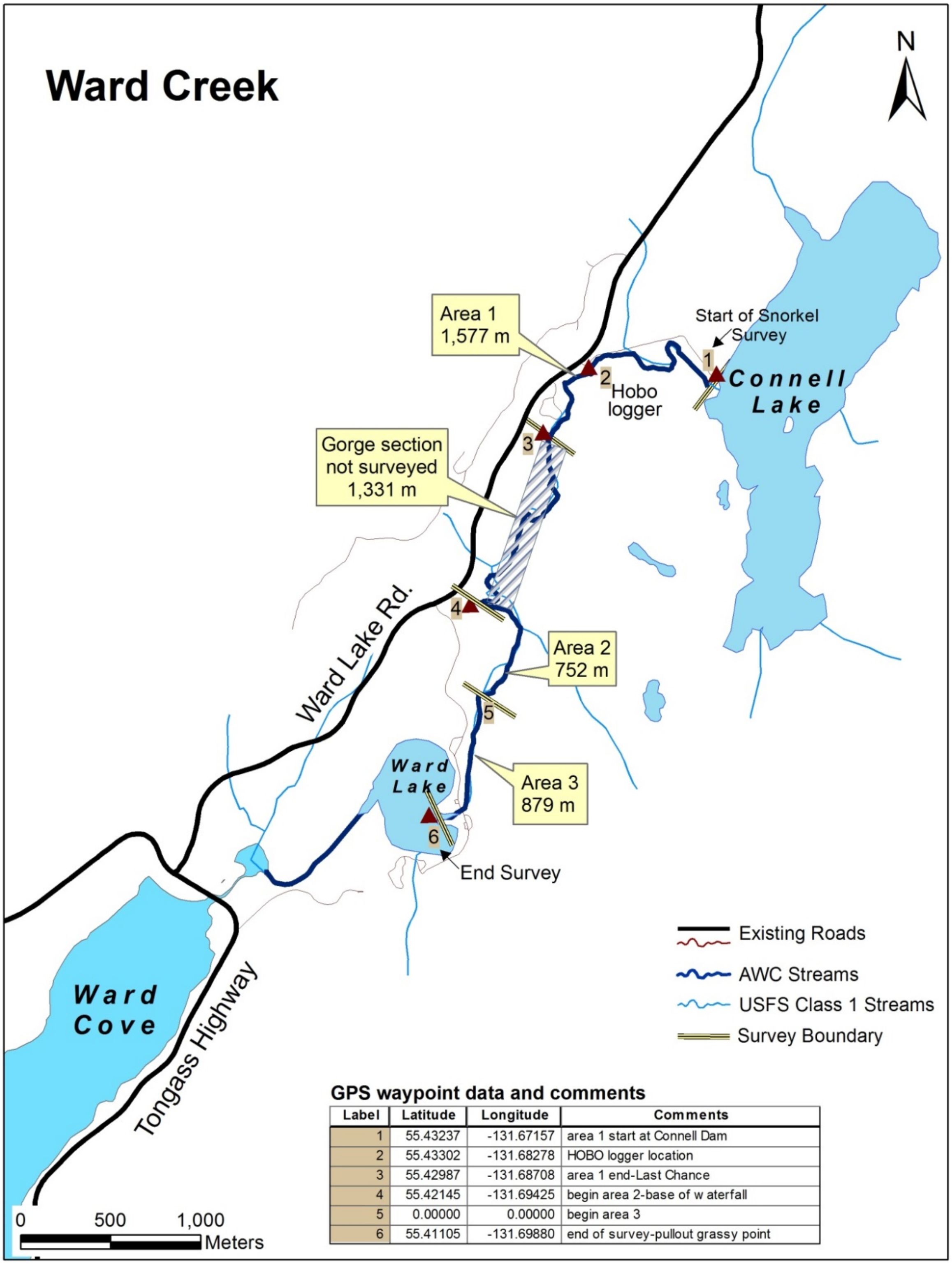
Appendix A2.–White River , Ketchikan Index Stream: AWC # 101-45-10240.



GPS waypoint data and comments

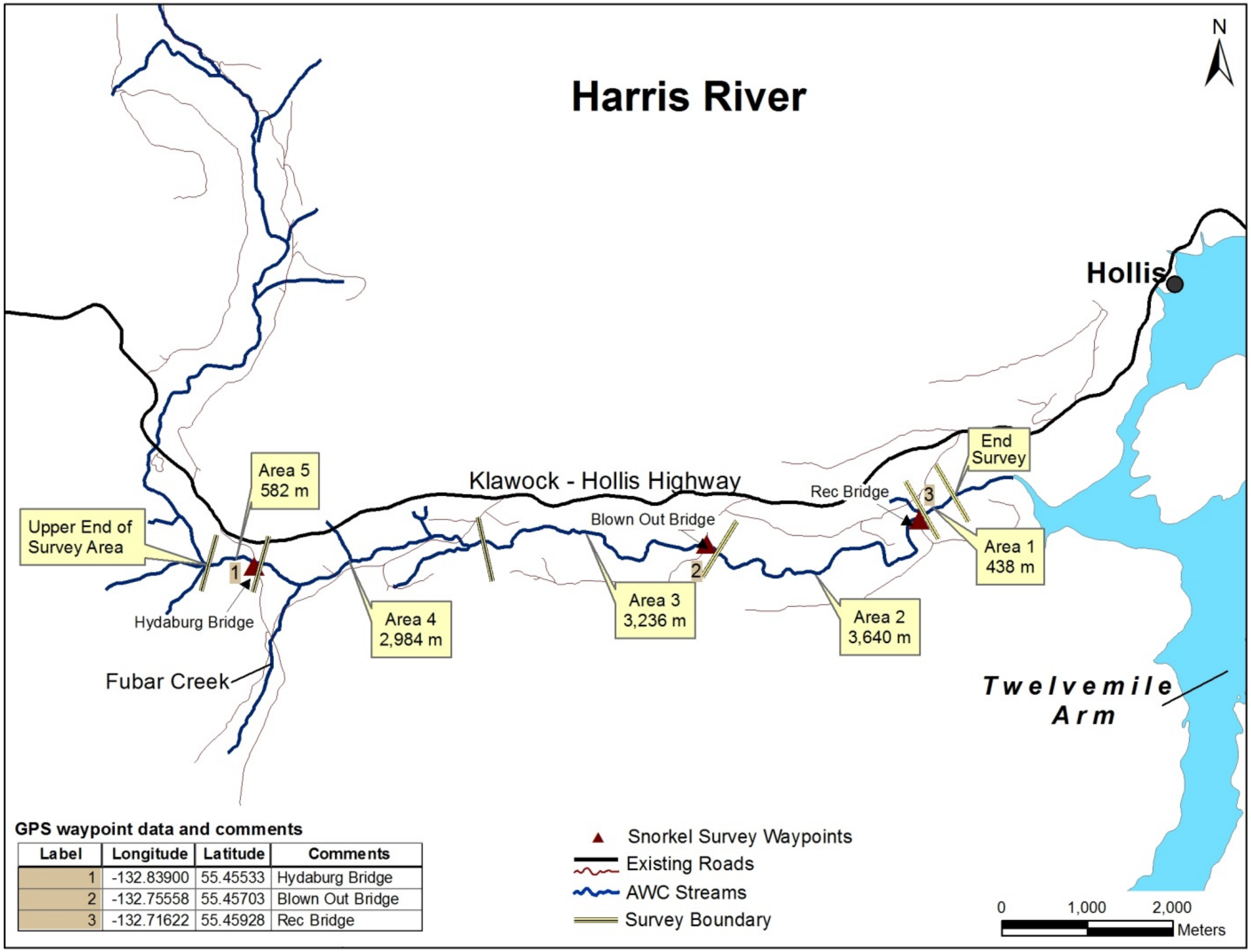
Label	Latitude	Longitude	Comment
1	55.41473	-131.69640	area 1 start
2	55.46047	-131.58345	begin area 2 - Pt. Charley
3	55.46655	-131.57355	begin area 3 - Frog Ponds
4	55.47283	-131.55955	end of survey - pullout downstream bridge

Appendix A3.–Ward Creek, Ketchikan Index Stream: AWC #101-47-10150.



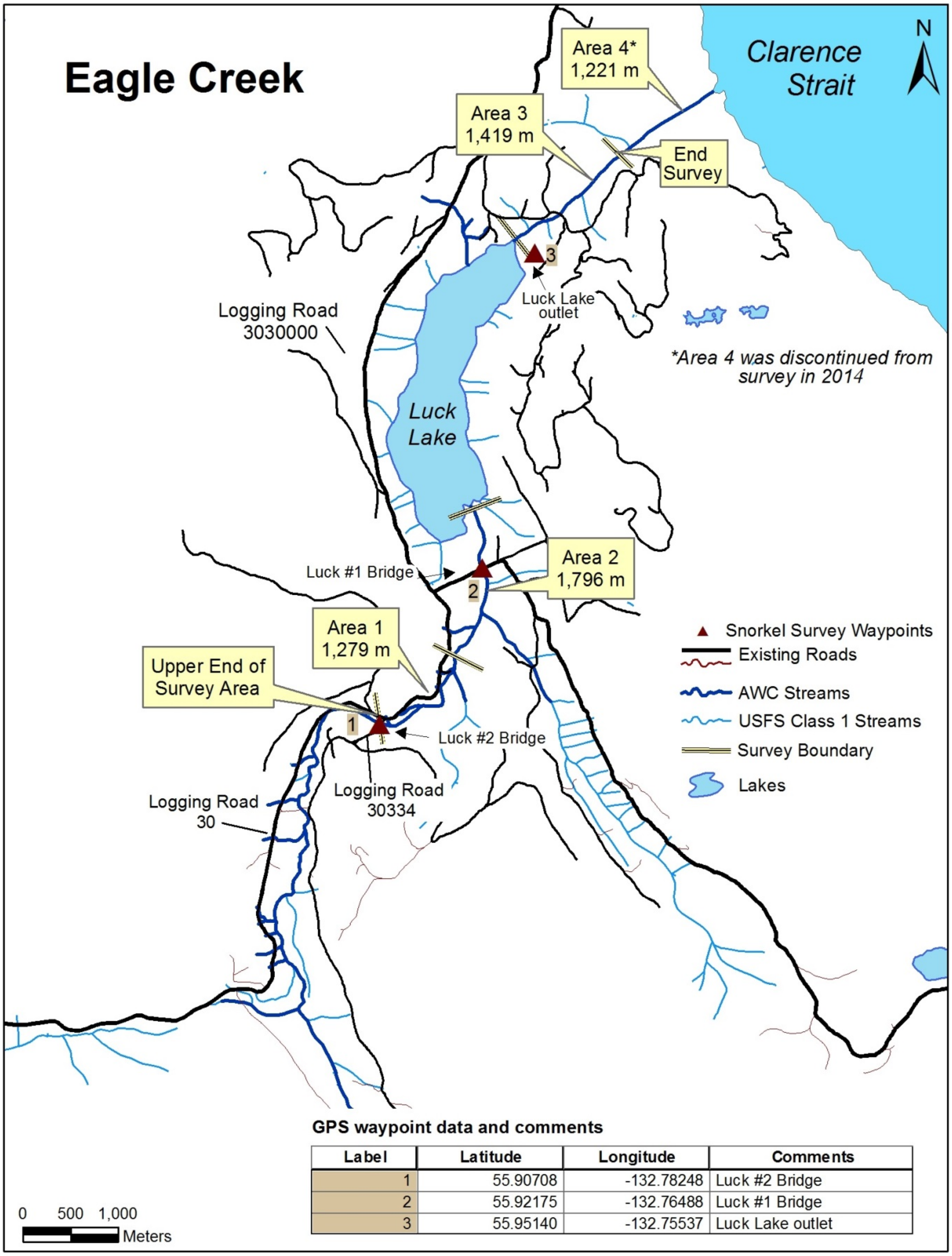
Label	Latitude	Longitude	Comments
1	55.43237	-131.67157	area 1 start at Connell Dam
2	55.43302	-131.68278	HOBO logger location
3	55.42987	-131.68708	area 1 end-Last Chance
4	55.42145	-131.69425	begin area 2-base of w aterfall
5	0.00000	0.00000	begin area 3
6	55.41105	-131.69880	end of survey-pullout grassy point

Appendix A4.–Harris River, Prince of Wales Index Stream: AWC # 102-60-10820.



Label	Longitude	Latitude	Comments
1	-132.83900	55.45533	Hydaburg Bridge
2	-132.75558	55.45703	Blown Out Bridge
3	-132.71622	55.45928	Rec Bridge

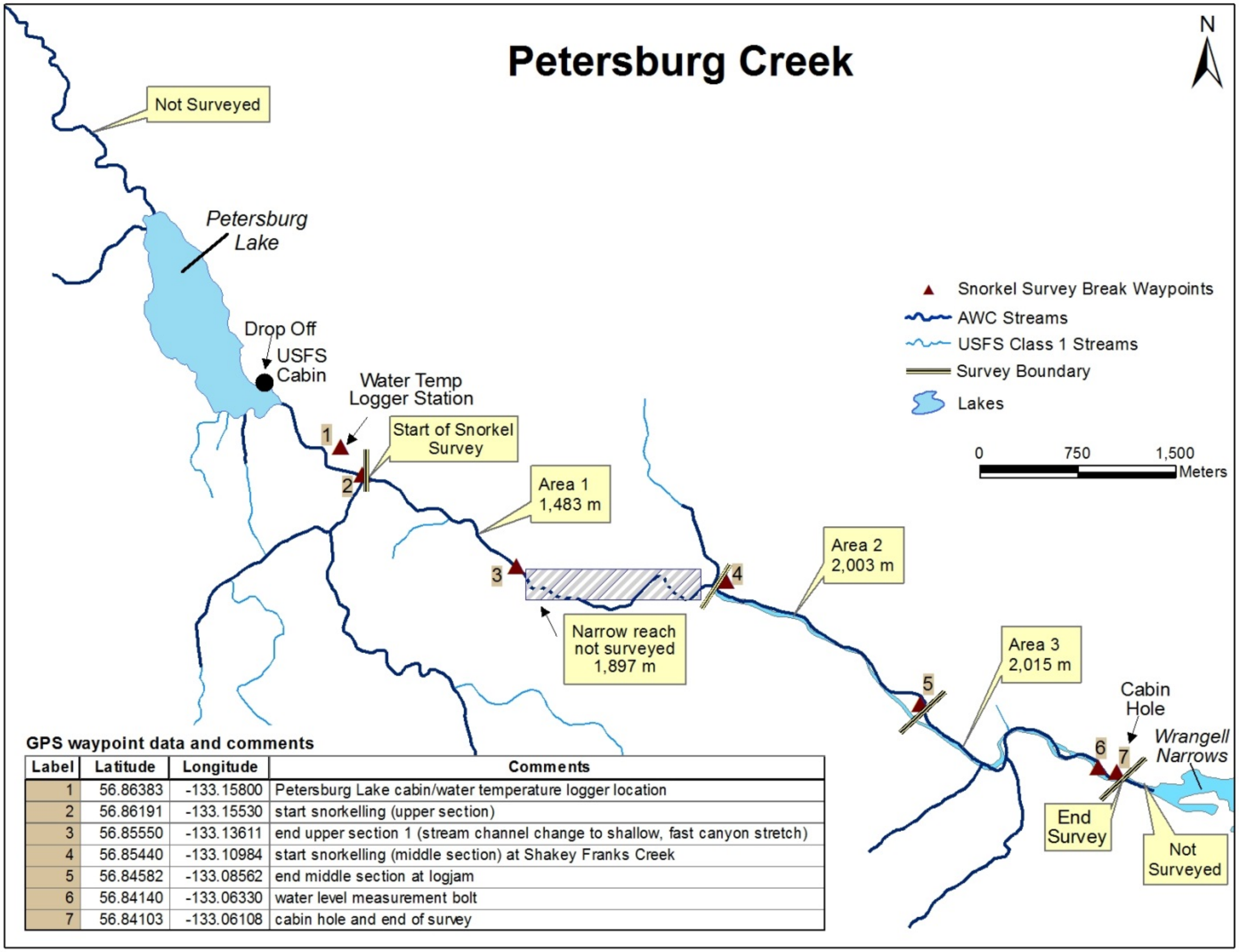
Appendix A5.–Eagle Creek, Prince of Wales Index Stream: AWC # 106-10-10300.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	55.90708	-132.78248	Luck #2 Bridge
2	55.92175	-132.76488	Luck #1 Bridge
3	55.95140	-132.75537	Luck Lake outlet

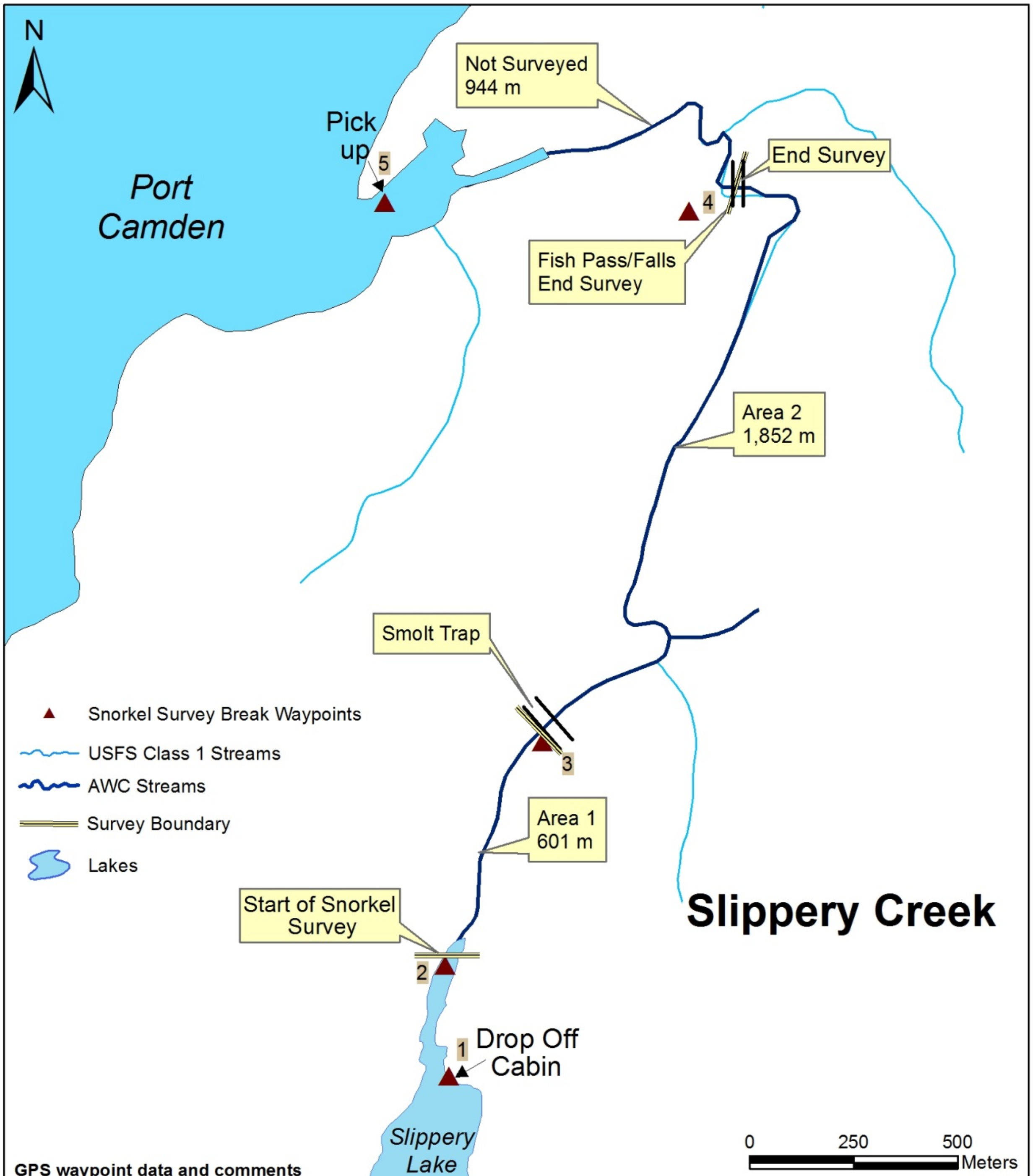
Appendix A6.–Petersburg Creek, Petersburg Index Stream: AWC # 106-44-10600.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	56.86383	-133.15800	Petersburg Lake cabin/water temperature logger location
2	56.86191	-133.15530	start snorkelling (upper section)
3	56.85550	-133.13611	end upper section 1 (stream channel change to shallow, fast canyon stretch)
4	56.85440	-133.10984	start snorkelling (middle section) at Shakey Franks Creek
5	56.84582	-133.08562	end middle section at logjam
6	56.84140	-133.06330	water level measurement bolt
7	56.84103	-133.06108	cabin hole and end of survey

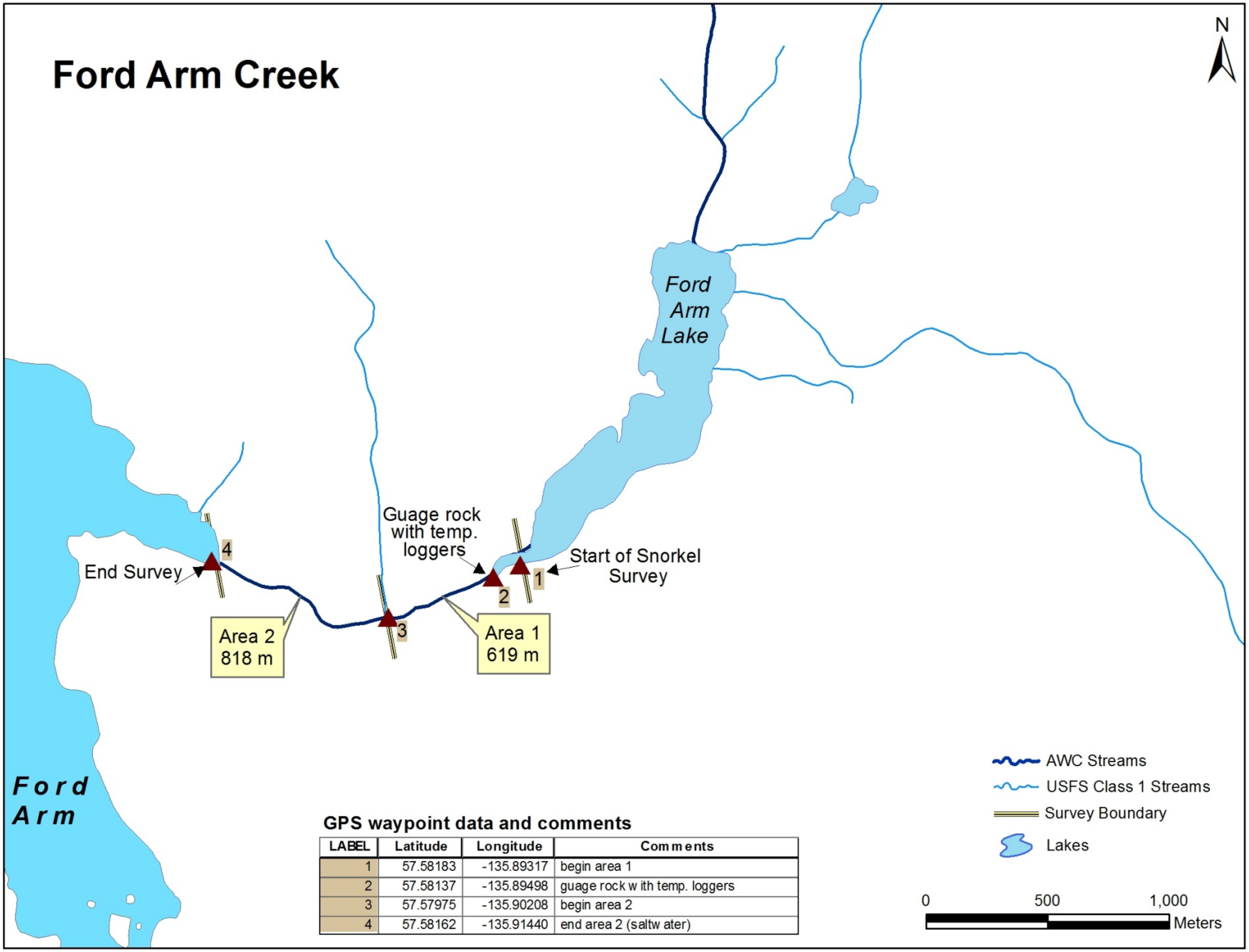
Appendix A7.–Slippery Creek, Petersburg Index Stream: AWC # 109-43-10030.



GPS waypoint data and comments

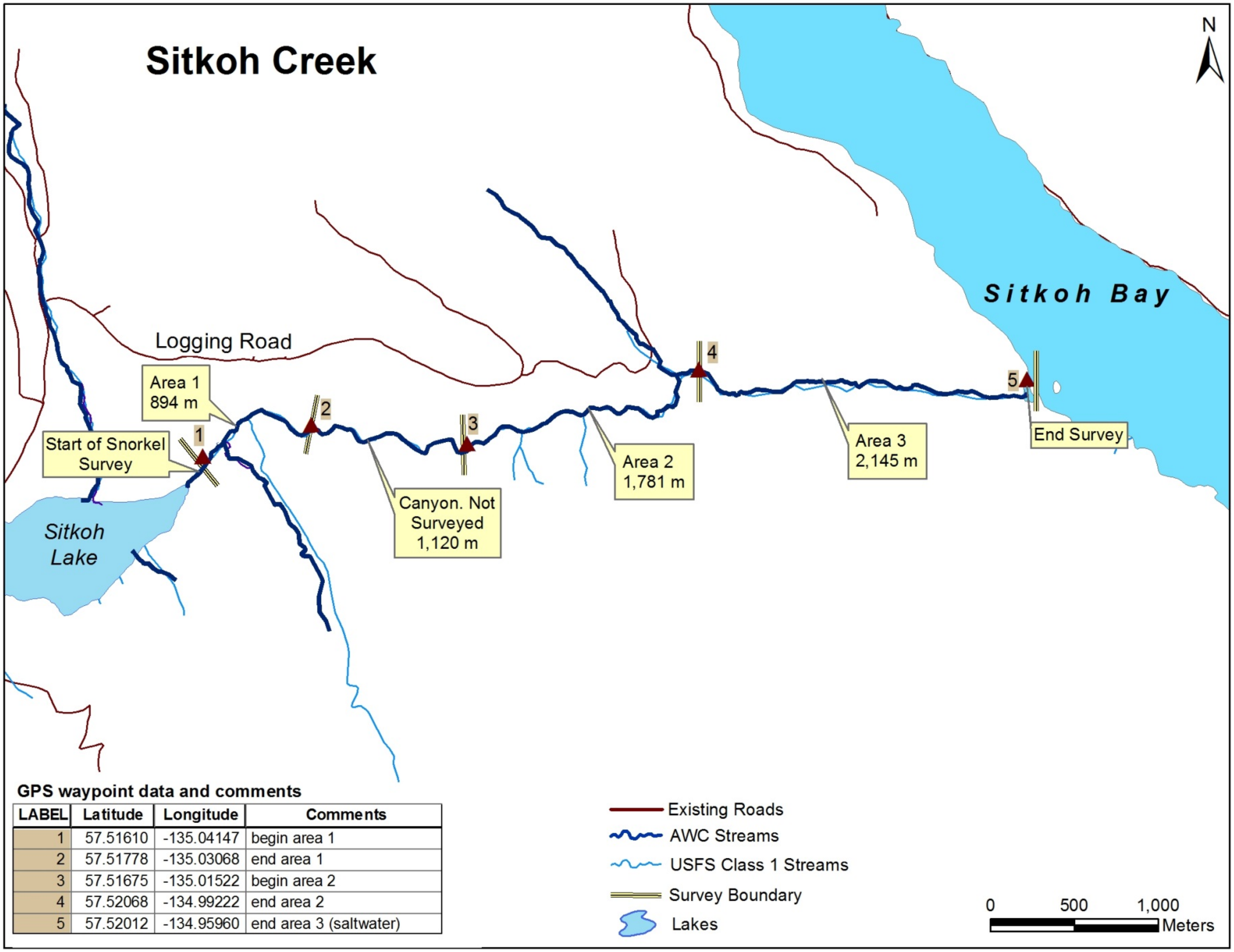
Label	Latitude	Longitude	Comments
1	56.6964	-133.88034	Fly to Slippery Lake cabin
2	56.6988	-133.88051	hike to lake outlet to start snorkel survey
3	56.7036	-133.87671	end snorkel upper section at smolt shack, water temperature logger here., start next section
4	56.7151	-133.87102	end survey section 2 at fish pass
5	56.7152	-133.88297	hike around bypassed lowermost section to tidewater; pick up at mouth Slippery Creek in Port Camden

Appendix A8.–Ford Arm Creek, Sitka Index Stream: AWC # 113-73-10030.



LABEL	Latitude	Longitude	Comments
1	57.58183	-135.89317	begin area 1
2	57.58137	-135.89498	guage rock w ith temp. loggers
3	57.57975	-135.90208	begin area 2
4	57.58162	-135.91440	end area 2 (saltw ater)

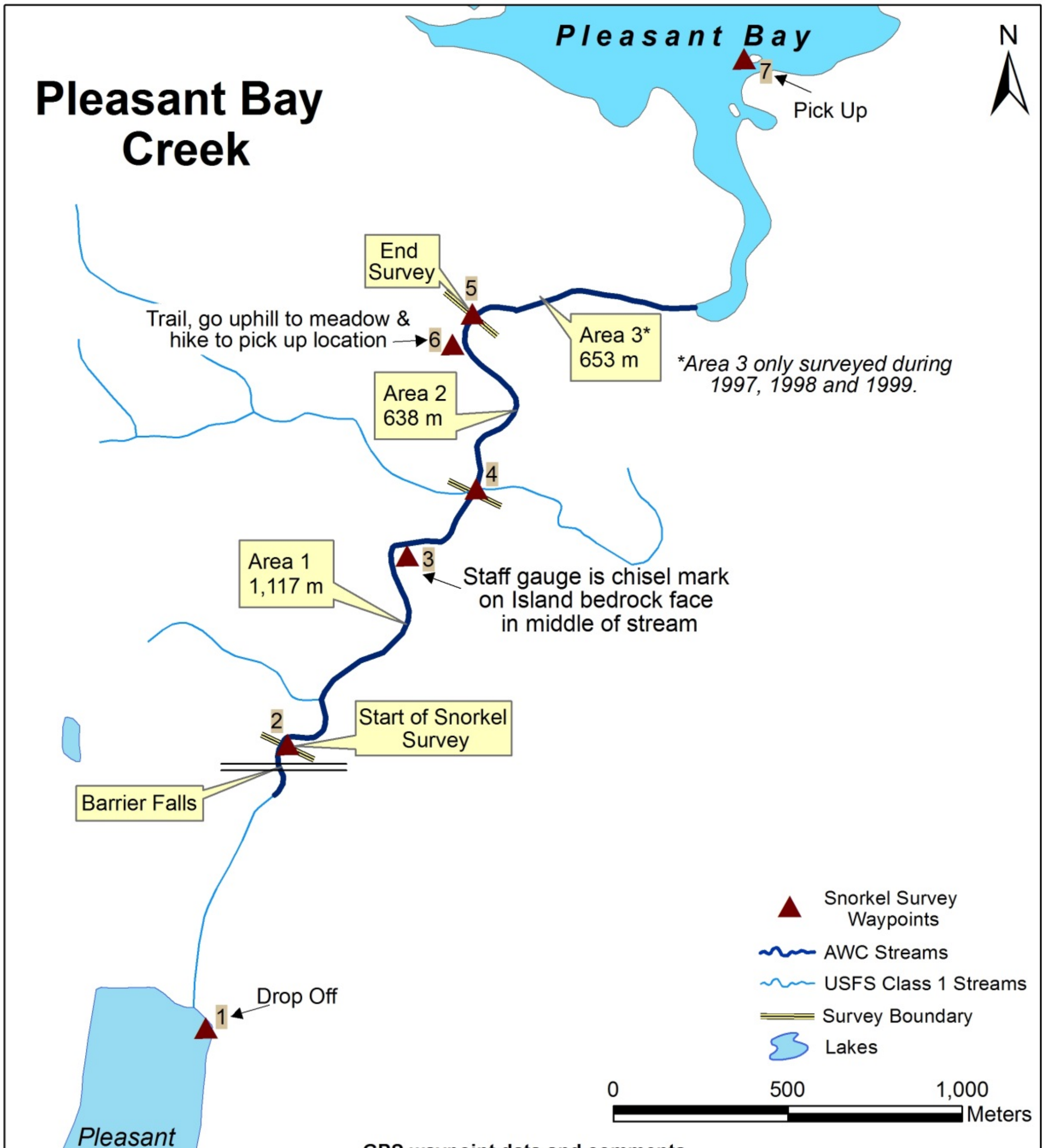
Appendix A9.–Sitkoh Creek, Sitka Index Stream: AWC # 113-59-10040.



GPS waypoint data and comments

LABEL	Latitude	Longitude	Comments
1	57.51610	-135.04147	begin area 1
2	57.51778	-135.03068	end area 1
3	57.51675	-135.01522	begin area 2
4	57.52068	-134.99222	end area 2
5	57.52012	-134.95960	end area 3 (saltwater)

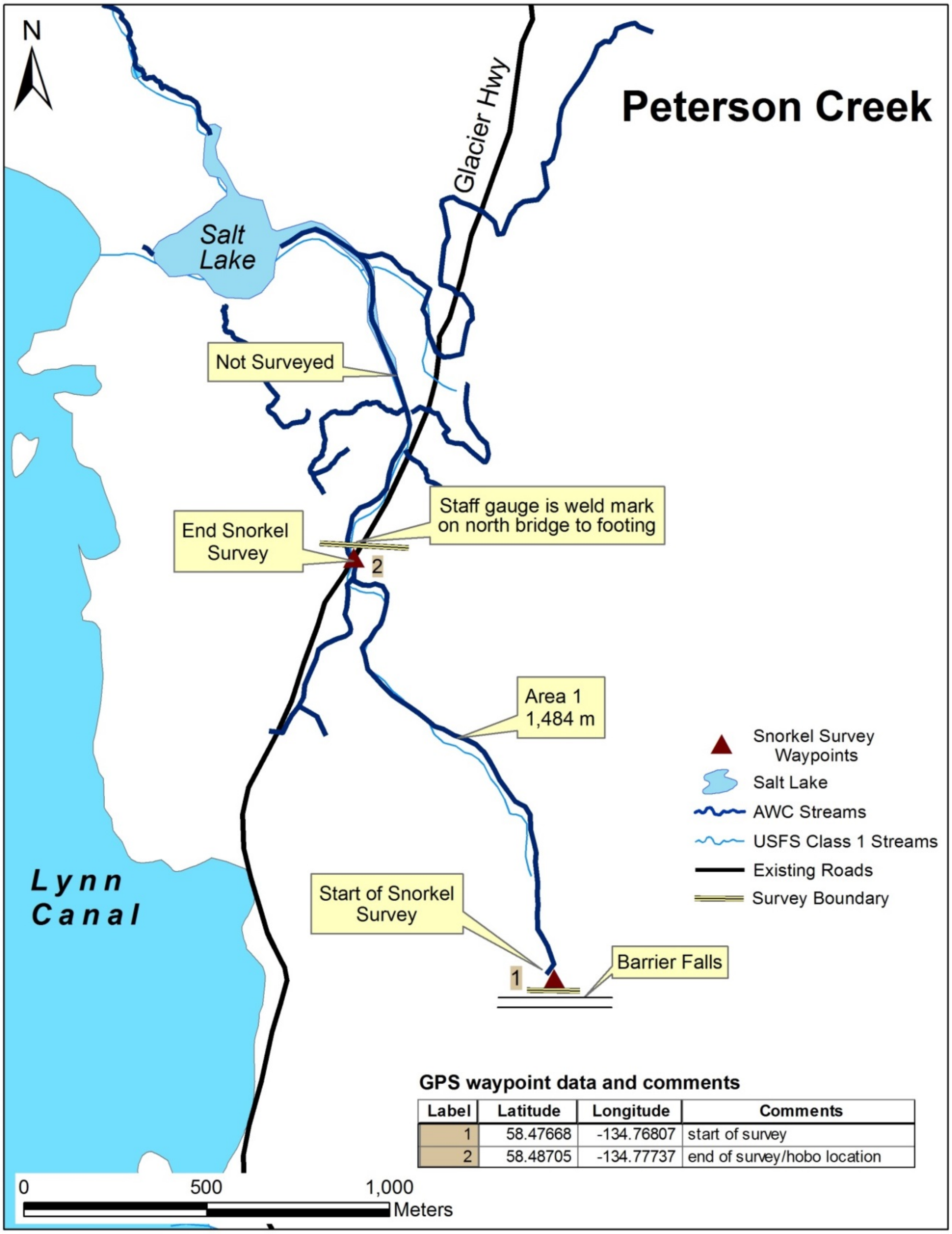
Appendix A10.–Pleasant Bay Creek, Juneau Index Stream: AWC # 111-12-10050.



GPS waypoint data and comments

Label	Latitude	Longitude	Comments
1	57.61230	-134.02054	plane drop off location on Pleasant Bay Lake
2	57.61956	-134.01640	start of snorkel survey
3	57.62437	-134.01051	staff gauge chisel mark on Island bedrock face
4	57.62607	-134.00713	end area 1/Hobo logger location
5	57.63057	-134.00718	end snorkel survey
6	57.62979	-134.00815	marks trail to take uphill to meadow for hike out
7	57.63701	-133.99393	pick up spot on river right in intertidal estuary

Appendix A11.–Peterson Creek, Juneau Index Stream: AWC # 111-50-10100.



Label	Latitude	Longitude	Comments
1	58.47668	-134.76807	start of survey
2	58.48705	-134.77737	end of survey/hobo location